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13. ABSTRACT (Maximum 200 words) Sedimentation rates in many Arctic Ocean cores need to be determined using paleomagnetic variations, carbonate concentration and radiocarbon age determinations because there is often an insufficient supply of biogenic material for biostratigraphic determination. Using these methods in the eastern basins, the sedimentation rates obtained are generally a few centimeters per thousand years, which is significantly higher than sedimentation rates within the western, Canadian Basin. In the western basin, where enough biogenic material is available for both radiocarbon age determination and stable isotopic analysis, sedimentation rates are about one order of magnitude lower. The oxygen isotopic records are highly variable, indicating that the records are affected significantly by melt water and riverine input. Missing stratigraphic sections and higher variability in oxygen isotopic composition preclude identifying the typical open ocean marine isotope stratigraphy. Sediments from the last glacial maximum (20ka) contain few fossils or are completely missing, implying that the Arctic may have been frozen year round during this extreme period of glaciation.					
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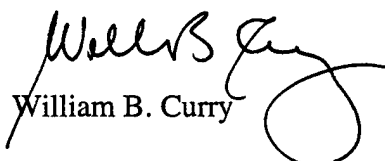
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In compliance with the reporting requirements on ONR Grant No. N00014-93-1-0709
entitled "Isotopic Variations in Arctic Pleistocene and Pliocene Marine Sediments"
PI, William B. Curry, enclosed are two copies of the report for your files.

Sincerely yours,


William B. Curry

WBC/amp

Enclosure

Final Report

ONR ASSERT Award N00014-93-1-0709

Title: Isotopic variation in Arctic Pleistocene and Pliocene Marine Sediments

PI: William Curry

Abstract

Sedimentation rates in many Arctic Ocean cores need to be determined using paleomagnetic variations, carbonate concentration and radiocarbon age determinations because there is often an insufficient supply of biogenic material for biostratigraphic determination. Using these method in the eastern basins, the sedimentation rates obtained are generally a few centimeters per thousand years, which is significantly higher than sedimentation rates within the western, Canadian Basin. In the western basin, where enough biogenic material is available for both radiocarbon age determination and stable isotopic analysis, sedimentation rates are about one order of magnitude lower. The oxygen isotopic records are highly variable, indicating that the records are affected significantly by melt water and riverine input. Missing stratigraphic sections and higher variability in oxygen isotopic composition preclude identifying the typical open ocean marine isotope stratigraphy. Sediments from the last glacial maximum (20ka) contain few fossils or are completely missing, implying that the Arctic may have been frozen year round during this extreme period of glaciation.

Students

Dana Stuart

Kirsten Laarkamp

Susan Aldermann

Graduate education and laboratory support were supplied to three students with this ASSERT award:

1) For Dana Stuart, the primary goal of the research was to determine the faunal and isotopic variation in foraminifera collected in sediment traps deployed in the monsoon region of the western Arabian Sea. The results show a strong monsoon signal in abundance of several species, including *G. bulloides*, *G. sacculifer*, *N. dutertrei* and *G. menardii*. The shallow dwelling species generally have isotopic compositions at or near to equilibrium with the sea surface temperatures as monitored in real-time by AVHRR observations from satellites. The deeper dwelling species are living within the thermocline. there are no clear indications in the foraminiferal shell density for secondary calcification affecting the foraminiferal oxygen isotopic composition. Covariation of carbon and oxygen isotopic composition parallels the covariation within the water column *G. sacculifer*, implying that it may be useful for reconstructing the past gradients of nutrient release within the thermocline of the Arabian Sea.

2) Fro Kirsten Laarkamp (ONR Graduate Fellow, 1993-1996), this award provided support for one of her two general examination papers. For her project, she reconstructed the history of deep water circulation using benthic foraminiferal carbon isotopic variations in the deep North Atlantic Ocean. Her results showed that production of North Atlantic Deep Water is strongly tied to the high frequency variations in North Atlantic climate observed in ice cores and surface waters. When the North Atlantic

region was cold, NADW was shutdown, providing evidence for a link of the thermohaline overturning in the North Atlantic ("the conveyor") to regional climate.

3) For Susan Aldermann, the award provided support for laboratory analyses for her Masters Thesis in the MIT/WHOI Joint Program in Oceanography. Her thesis was on the observed changes in foraminiferal flux and isotopic composition observed in a sediment trap from the Sea of Okhotsk. Her principal results show that the population of foraminifera are calcifying in the upper 30 meters of the water column, constrained to shallow depths by the presence of the very cold dichothermal layer at about 100 meters. The coiling ratio of *N. pachyderma*, which in other locations around the world shows a change in direction at about 7 to 10 °C, is less sensitive to temperature here. In this location, left coiling *N. pachyderma* are found in waters where surface temperatures are as warm as 14 °C because they are able to find much colder water only several tens of meters below the sea surface. Inasmuch as the Sea of Okhotsk is an analogue for the glacial North Atlantic, reconstruction of past SSTs which rely on *N. pachyderma* (l) may be biased. (Note: Susan Aldermann's stipend was supported through other ONR grants, including ASSERT award N00014-93-1-1141. Only her laboratory analyses were supported with this award.)

Publications

- Polyak, L. and Curry, W. B., (1995). New insights into Quaternary paleoceanography of the Arctic Ocean: Stable isotope and foraminiferal record from the Mendeleev Ridge, Amerasian Basin. EOS, Transactions of the American Geophysical Union, v. 76, p. F295.
- Aldermann, S. Honjo, S. and Curry, W., (1996). Seasonal transition of species composition and isotopic variability of planktonic foraminifera in the Sea of Okhotsk. EOS, Transactions of the American Geophysical Union, v. 76, p. OS76.
- Aldermann, Susan, (1996). Planktonic foraminifera in the Sea of Okhotsk: population and stable isotopic analysis from a sediment trap. MIT/WHOI Joint Program in oceanography, Masters Thesis, 99 pp.
- Schneider, D. A., Backman, J., Curry, W. B., and Possnert, G., (1996). Paleomagnetic constraints on sedimentation rates in the eastern Arctic Ocean. Quaternary Research, v. 46, pp. 62-71.
- Stuart, D. , (1997). Deciphering isotopic signals for monsoon-induced upwelling in foraminifera from the western Arabian Sea sediment trap. MIT/WHOI Joint Program in Oceanography, Masters Thesis.
- Poore, R. Z., Phillips, R. L., Curry, W. B., and Osterman, L. E., (1998). Late Pleistocene and Holocene Paleoceanographic record from the western Arctic Ocean. EOS, Transactions of the American Geophysical Union, v. 79, p. S177.
- Poore, R. Z., Osterman, L. E., Curry, W. B., and Phillips, R. L., (1998). Marine isotope stages 1 and 3 in the western Arctic Ocean. AGU Chapman Conference on "Mechanisms of Millennial Scale Climate Change. Snowbird, Utah.